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I.

ANNUAL ADDRESS.

By Prof. Daniel C. Gilman,
Of Sheffield Scientific School, Yale College.

Subject: THE LAST TEN YEARS OF GEOGRAPHICAL WORK IN THIS COUNTRY.

Read January 31st, 1871.

Mr. President: My theme will be the contributions to geographical science made within the last ten years, relative to the territory of the United States. The subject is quite too vast for a single lecture; but I shall call your attention to the more important points, and show in what method the results can best be reached by the student of geography.

I. Who have been the Workers?

Most deserving of mention are the various departments of the United States Government, including the coast survey, the engineers of the army, the surveyors of the Land Office, the cartographers of the Indian Bureau, the Hydrographic Bureau, the government county boundary commissions, and the Smithsonian Institution.

Two of these organizations deserve special recognition. The United States Coast Survey is one which, under the successive administrations of Hassler, Bache and Pierce, has added so much to the scientific renown of the country, and has furnished us with such accurate knowledge, not only of the coast, but of the subaqueous bottom upon the Atlantic, the Gulf and the Pacific shores, and also, during the war, so many important regions of the interior. The latest volume of the survey, recently published, though bearing date for the year 1867 (being the first issued under the general administration of Mr. Pierce), is more than usually explicit in respect to the exact status of the survey, and contains a good outline map, by which its exact progress on the Atlantic coast may readily be ascertained. Less familiarly known to the public in general, but likewise highly meritorious, is the work of the engineer of the army, which, in time of peace, is largely directed (in addition to the building of fortifications) to the examination of our rivers, of our lakes; to the determination of new routes through the western country, and of the best methods of improving and developing our interior resources.

II. In addition to the work of the general government, many of the separate States and Territories are also engaged on a more or less comprehensive plan in the maintenance of geological surveys, boundary measurements, and other investigations respecting the interior structure and natural resources of the various regions; and the neighboring Dominion of Canada, in the prosecution of its geological survey, has made very important contributions to the knowledge of the geology of the United States, especially in the northern and eastern regions. Among all the surveys of the several States none is more deserving of honor than that of California, conducted by Prof. I. D. Whiting, while the recent maps published by the surveys of New Jersey, Ohio and Indiana also deserve notice.

III. In addition to these governmental investigations, the great corporations engaged in the construction of railroads, and in kindred public works, are continually adding to our knowledge of the interior. If it be said that a corporation has no soul, it cannot be claimed that it has no intellect, for the highest intellectual forces of the country have been employed upon the survey of new routes of transit, especially through our western mountains. It is only necessary to mention the Union and Central Pacific railroads now completed, the Kansas Pacific, and Northern Pacific railroads, and the work of the Western Union Telegraph Company, which have all added so much to our knowledge of the west.

IV. We have also the enterprises of private individuals, inspired by a love of science, adventure or fame, which have led so many men of eminent ability, by so many different routes, into so many different places, and often with such vast results for geographical science.

We may briefly mention among the most noteworthy, the exploration of Powell on the canon of the Colorado, of Whitney and Brewer in the measurement of lofty peaks, and of Marsh and his party of student geologists along the route of the Central and Union Pacific railroads, of Langford, Washburn and their associates to the geysers of Montana, and the able writer, Richardson, and many other observing travelers and letter-writers, whose books contain bright pictures of the condition of society, even if they do not add much to our knowledge of the physical peculiarities of the country.

Where are the Results?

These, then, are the workers. Where are their results to be found? In the first place, we look for them in the government offices at Washington, in the manuscript records, in the printed documents, irregularly distributed, often very inaccessible to those who are most desirous of obtaining their contents. The extreme difficulty of ascertaining what there is in the various departments of the general government is only surpassed by the difficulty of knowing how to get at it. The various workers to whom reference has been made, in their official labors are responsible to the different departments of the general government; for example, it is in the War Department that we find the work of the army engineers and other military officers; but not all the work of the army officers is at once reported to the head quarters at Washington; much of it remains in the hands of the heads of the military departments, especially of the Pacific slope. The coast survey is under the direction of the Secretary of the Treasury. To this department we must go for the results accomplished by the Land Office and the Indian Bureau.

The Post-office Department makes its own maps. Commissions for the settlement of its national boundaries are responsible to the Department of State. The Navy Department maintains the Hydrographic Bureau. The Smithsonian Institution co-operates with explorers and investigators in any or in all of these departments; and, to crown all, both in the Senate and the House of Representatives, special congressional committees often bring out and print and publish important papers and memoirs, which proceed not from any one of the established departments of the government. Now, it is very puzzling to the geographical student, in consequence of the mode in which these various papers are distributed, to know how to bring together, at any one time, the results of so many different investigations. It sometimes appears as if these departments were not acquainted with each other's work, and felt still less of interest in the work of savans who are engaged in similar researches. Some of these facts may point to the incompleteness of our civil service; for while we have so many able officers of the government engaged in investigations of the highest value to mankind, much of their usefulness is impaired by the defective arrangements for gathering up, presenting and distributing to the public the results thus ascertained. They likewise point to the importance of having established in Washington, or elsewhere, as a department of the general government, a bureau of maps and charts and geographical memoirs, where all these vast accumulations may be stored, classified and rendered accessible, like the books in the library of Congress, or the books and models in the Patent Office, so that persons who have the right may make inquiry respecting them.

We must also turn to the Transactions of scientific associations; and although we have but one Geographical Society in the country, there are many learned bodies which are accustomed to print important data in the different departments of geographical science. Not to mention those with which we are most familiar, in the Eastern States, it is fit to notice here that three Western cities — San Francisco, St. Louis and Chicago — are publishing Transactions of very great value to the students of geography. In the former, we may find many papers by Whitney, Williamson, Hoffman and other workers on the Pacific coast. The St. Louis Transactions contain many of the results to which Parry and Engelman have arrived, and the newer volume of the Chicago Academy gives us a most interesting account of the life and work of the lamented Kennicott.

We must turn, also, to the journals and newspapers; not merely those of scientific reputation, like the American Journal of Science and the American Naturalist, but to the literary periodicals, many of the articles of which have a mountain flavor — the Overland Monthly, Harper, Lippincott and the Atlantic; for they, as well as the daily newspapers, bring out, over the signatures of the authors, many important papers which the student cannot possibly pass by.

There is no time for me to dwell upon the books of travel, written so frequently in these days, by those who pass from ocean to ocean.

Photographs, likewise, should be collected and studied, if we would have accurate conceptions of the regions which we cannot ourselves visit, for they often convey to the eye clearer impressions of the structure of the country than many pages of description. Finally, we must turn to the general maps, which, in the language of cartography, may be supposed to present to us, adjusted and winnowed, the combined results from multitudes of investigations. Five government maps hang before you, recently published by different departments of the government, which exhibit, down to a very recent period, the progress of investigation in this country. On the map of the Post-office Department is delineated the position of all postal stations and the ordinary routes of communication between them. On the map of the Indian Bureau we see what is now known respecting the distribution of the aboriginal tribes in the far west. The map of the Land Office is intended to exhibit that portion of the public domain already surveyed by the general government, and so far as that, at least, appropriated for settlement. On it are noted, also, the deposits of precious and useful metals; but it is a map without mountains, and, therefore, of little consequence to the student of topography.

For topographical knowledge, we must turn to the work of the engineers in the War Department. The well-known map of Gen. Warren, successively re-edited and republished, gives us, in four sheets, the most minute general exhibition of what is known to the engineers respecting the topography of our country west of the Mississippi; while the smaller map, covering the entire territory of the United States, and published still more recently,,exhibits to the eye, not merely the topography and hydrography, but also the railroad routes, the position of important towns, and, consequently, the proper military lines of communication.

But if we turn from maps to literary or descriptive generalizations of the knowledge thus ascertained respecting our territory, we look in vain for anything which is satisfactory. A few pages in Dana's Geology, or a few in Whitney's Guide to the Yo Semite valley, brief and concise as they are, give, perhaps, better notions respecting the western territory than can be ascertained from any larger works. It is hardly time for any one, within the limits of any single volume, or even any single article, to sum up and give to the world, in language, a picture of our western territory, for every year and every month are adding to our knowledge.

From this brief sketch of the workers, and of the places to which we must turn in order to ascertain their results, let us proceed to consider somewhat more in detail the contributions which have been made to our knowledge of the physical structure of the United States. We shall find it convenient to consider consecutively three distinct regions—the Appalachian system, the Mississippi valley and the Cordilleras, to which may be added some notice of our new possessions in Alaska.

By the Appalachian region we understand the lofty ranges of mountains which culminate, in the north, in the White Mountains of New Hampshire, and on the south in the Black Doe, and its adjacent peaks in North Carolina, together with the Atlantic slope, and what we know of the submerged coast.

By the Mississippi region we understand the great basin which lies between the Appalachians on the east and the Rocky Mountains on the west, extending from the vast system of lakes on the north to the Gulf of Mexico on the south, and including the area drained by the Missouri on the one side and the Ohio on the opposite.

The term "Cordilleras of the United States," as proposed by Prof. Whitney, and accepted by many others, is a fit designation for all that vast and intricate system of upheavals lying along the western portion of our territory, including the Rocky Mountains and their prolongation to the north, the basins and mountain chains of the interior plateau, with the Sierras and Cascade Mountains of the Pacific. Let us briefly see what has been done in each of these three great divisions of our territory.

The best general map which we have of our Appalachian chain is that prepared by Mr. Ernest Landoz, originally published in Petermann's Journal, and reprinted in the American Journal of Science. It embodies the original researches of Guyot, in addition to the data obtained by other mountain measurers. I speak of it more particularly, as it often escapes the notice of those most interested in its facts, and because the memoir of Guyot, published in connection with it, brings together so much that is exact and important respecting the structure of this mountain system, an acquaintance with which is fundamental to our acquaintance with the Atlantic region. The United States Engineer Bureau, since the war closed, has been engaged in making beautiful and minute delineations of the most important battle-fields east of the Appalachian regions. Fifteen hundred square miles have been surveyed, and the results of the work have been brought out in nearly two hundred sheets. The index map, which hangs before you, shows how much of the territory has thus been covered. When we see the minuteness and completeness of this work, it makes us long to have a similar investigation prosecuted along the entire seaboard.

The Coast Survey, in addition to its peculiar work, has co-operated with the city of Portland, in Maine, in the production of a map of that harbor and the adjacent region, which is a fine sample of what may be done for any of our large towns. Of a very different character, though equally noteworthy, is a paper on the topography of New Haven, recently published by Prof. Dana, in which we have a good sample of the work of an able geologist in his travels about home. The State of Maine, influenced, doubtless, by a regard for the financial prosperity of that district, has published a volume illustrative of the river courses and the tributary regions of that State; and, although the maps are not all that we could desire, the enterprise thus displayed is worthy of commendation.

Through the geological survey of New Jersey, we have, also, a new and important map of that State, which is wanting in the delineation of mountains, but is full and accurate in the presentation of the river courses and coast lines, and is also colored to exhibit the geological strata. Many noteworthy researches have been in progress, under the direction of the engineers of the army, for the improvement of the various rivers of this coast, but, for the most part, the results are given to the public in the most general forms.

On the whole, it is rather a disgrace to us that so little has been done, within the last ten years, for adding to our knowledge of this, the oldest, the most enlightened and the most thickly populated portion of our territory. We have, at this day, many better maps of vast regions in the Cordilleras than we have of the eastern States; and many amusing, if they were not unfortunate, illustrations of our defective knowledge of the east might be cited. For example, when the marshal of the State of Connecticut applied to the authorities of the State for a map, on which could be based the investigations of the census of 1870, it was impossible to furnish one of sufficient accuracy, for the published areas of that little State differ several hundred square miles in extent. If this be true, it can hardly be surprising that the popular guide-book, sold to all the travelers who go up the Connecticut valley, in their summer journeys to the White Mountains and various other resorts, informs the passer-by that the first lands seen by the mariner, as he enters the harbor of New Haven, are the hanging hills of Meriden, between New Haven and Hartford. A school-book on geography is still published in one of our eastern towns, in which it is stated that the White Mountains are so called because their summits are above the level of perpetual snow. It is not many weeks since I received a letter from Prof. Guyot, in which he said that he had ascertained, during the last summer, not only that the highest peak, so called, of the Catskill Mountains was not in reality the highest peak, but that there are several near to it which surpassed in altitude the so-called summit; and this in the vicinity of one of our most favored places of resort during the summer season. To this day, the best general map of New England, exhibiting its natural structure, with which I am familar, is that which illustrates the "History of New England," by Dr. Palfrey, published about ten years ago.

I dwell upon these points, not for the sake of publishing our ignorance, but to excite those who are fond of geographical investigation and inquiry to greater diligence in the study of their own neighborhoods. Why should there not be Appalachian clubs as well as Alpine clubs for the investigation of this most beautiful and diversified country?

If we turn from the Appalachian region to the great interior valley which so thoroughly characterizes the structure of the United States, we shall discover that it is to the engineers of the United States Army that we are most indebted. Chief among many valuable contributions stands the elaborate and wonderful treatise on the physics and hydraulics of the Mississippi river, by Generals A. A. Humphreys and H. L. Abbott, which will always deserve to be everywhere recognized as among the great contributions of the army to the science of the country. It is valuable in a great variety of aspects, but it is chiefly to be noticed in this connection for its accurate and systematic survey, not only of the chief river, the Mississippi, but also of all the various tributaries which flow into that great stream. Besides this survey of the Mississippi river, the engineer department has given us a survey of the northern lakes, which rivals in beauty and accuracy any similar hydrographic work. It would be utterly impossible for me to give you, within the limits of this lecture, any adequate conception of the variety of investigations which the Engineer Department have undertaken in the interior, and of the thoroughness with which their work has been done under the general guidance of the chief of the corps, Gen. A. A. Humphreys. Turn only to the volume of 1870, the last which has been published, in which you may find notices of the investigations which were making in respect to the geological age of the Mississippi Delta ; of the investigations showing the feasibility of storing water in the lakes at the head waters of the upper Mississippi river, so as to secure a good navigable stage of water at all times ; an inquiry into the possibility of stopping the recession of the Falls of St. Anthony ; an account of the continued progress of the lake survey under Lieut.-Col. Raynolds ; and a statement of the progress of the publication of maps of campaigns and battle-fields.

There are various geological surveys in progress under the direction of the various States of the interior and of the United States Geologist, Dr. Hayden, and Prof. I. S. Newberry, has presented general conclusions in respect to the structure of the Interior Basin.

When we turn from the interior valley to the great mountain upheavals known under the general name of the Cordilleras, it is still more difficult to sum up and generalize the work that has been accomplished. Among most interesting topics to be considered are :

(1.) The work of the great railroad corporations — central, northern and southern — already alluded to.

(2.) The work of the North-western Boundary Commission.

(3.) The work of the California Geological Survey.

(4.) The exploration of the Colorado canon.

(5.) The survey of the fortieth parallel by Mr. King and his associates, under the auspices of the United States engineers.

(6.) The examination of the Colorado peaks and parks by Parry and Engelmann, by Whitney, Brewer and Hoffman, by Gilpin and by others.

(7.) The surprising stories which come to us of the geysers of the Upper Yellowstone.

(8.) The surveys in Washington Territory.

(9.) The work of Wheeler in western Nevada; and

(10.) The survey of Arizona, by Gardner.

I doubt whether any one will question that the most important geographical work, during the period which we are considering, is the survey of the State of California, commenced in 1860, and still (after an unfortunate interruption) going forward under the guidance of Prof. J. D. Whitney. When we consider the vast area of the State of California, which is twenty-four times the area of the State of Massachusetts, and nearly equal to the area of all New England, New York, Pennsylvania and Ohio; when we consider that fourteen-fifteenths of the territory may rightly be called mountains; when we consider the very interesting structure of the territory, both in its general outlines and in its detailed features, together with the great mineral, agricultural and commercial advantages of the region, we must rejoice that at so early a period in its career as a member of the American Union, "the Golden State" has undertaken this survey, and has entrusted its guidance to one of the most learned and efficient men of science which our country has produced. Technically, the work entrusted to Prof. Whitney is that of a geological survey; but he has rightly determined that no good geological work could be published unless it were based upon a good topographical survey; so he has everywhere entered upon measurements of heights and distances; has explored vast regions hitherto unexplored; has worked over the existing geographical material accumulated in the Land Office and in the Pacific Railroad reports, and has prepared for publication a series of admirably drawn maps, two of which, at least, are now before the public. He has also examined the botany and the zoology of the State, as well as the mines and mineral resources, having been aided by Prof. W. H. Brewer, as chief assistant; by Messrs. Ashburner, Hoffman, Cooper, Gabb, Gardner and King, and others in different departments of the work. Three large volumes have already appeared, the first of which is a sort of historical record of the work of the survey; several more volumes are contemplated — possibly twelve or thirteen — one of which will be devoted to the physical geography of California. Such a theme, under such treatment, will make a book of surpassing interest. The survey, thus carried forward, has made clear the general structure of the country which is thus described by Prof. Whitney.

In order to bring vividly before the mind the grand simplicity of the topographical features of California, we may draw on the map of the State five equi-distant parallel lines, having a direction north thirty-one degrees west, and fifty-five miles apart.

Let the middle one of these be drawn at the western base of the Sierra Nevada, touching the edge of the foothills, as it will be found to do with the given direction, from Visalea to Red Bluff; the first parallel line east of this, drawn at fifty-five miles distance, will pass through or very near the highest points of the Sierra Nevada, beginning with Mt. Shasta on the north, and touching in succession, toward the south, first Lassen's Peak, then Spanish Peak, Pilot Peak, the Downeyville Buttes, Pyramid Peak, Castle Peak, Mt. Dana, to Mt. San Bernardino and San Jacinto, touching also the high group of peaks discovered during the explorations of 1864. This line, if straight, would pass very near the culminating peaks of the Sierras for 500 miles.

The next parallel east of this (at the same distance of fifty-five miles) crosses a series of depressions, occupied by lakes and deserts. The Klamath, Wright, Pyramid and Walker lakes, Death valley, Soda lake and the sink of the Mojave lie on it.

The first line to the west of the central one will be found to follow very closely the eastern base of the coast ranges, from near Kern lake northward, for near 300 miles.

The second line west, and last parallel, represents very nearly the coast line of the Pacific, or the western base of the coast ranges. * * * These lines divide the State into four belts of nearly equal width, which preserve their main physical features over about five degrees of latitude, and for a distance of 400 miles, which embrace the most important part of the State, comprising nearly the whole of the agricultural, and by far the most of the mineral districts. These belts are designated as follows, naming them from the east to the west: The Eastern Slope, the Sierra Nevada, the Great Californian Valley and the Coast Ranges.

One of the most noteworthy and generally interesting results of the survey has been the discovery of a region of mountain peaks in the south-eastern portion of the State, between the parallels 36° and 37°, which were found to contain the loftiest peaks yet known to be in existence within the limits of the United States, not taking into account Mt. St. Elias on the boundary of Alaska, the height of which is still undetermined with precision. The colossal magnitude of this mountain mass, which may be known under the appellation of the "High Sierra," entitles it to the most respectful consideration in a review like the present.

During the summer of 1864, a reconnoissance was made of a region hitherto entirely unknown, lying between the Yo Semite trail to Mono lake, on the north, and Walker's pass, on the south. Glimpses of these summits from Mt. Bullion, had led Mr. King to suppose that here were the most elevated summits, and, accordingly, a party under the lead of Prof. Brewer, consisting of Messrs. Hoffman, King, Gardner and Cotter, and protected by a military escort, was fitted out to ascertain the truth. Three summer months were spent on the expedition, the crowning glory of which was the discovery of a peak more than 15,000 feet, several over 14,000 in elevation, and many above 13,000; the group constituting, in the opinion of Prof. Whitney, "the grandest mountain mass of the North American continent." An area of over 10,000 square miles was examined, of which previously not even the topographical outlines were known.

The limits of this address will not permit even a summary of the account which is given in the first volume of the Report of the Geological Survey of California, but some reference *must* be made to the highest point of interest.

Probably as much that is grand and instructive can be seen from Mt. Brewer as from any other one position; for although a thousand feet or more (13,886) lower than the highest peak, it stands in such a relation to it, and to the other fourteen-thousanders, that the view upon its summit is described as one of the most sublime even in the sublimest portion of the Sierra. It is the culminating point of the western ridge of the Sierra, its sides rising very steep through the first 12,000 feet of ascent, — the southern wall being almost vertical for 1,000 feet. Snowy peaks over 11,000 feet in height cover an area of twenty-five square miles. Ten miles east is a ridge or crest on which are the summits known as Tyndall, Williamson and Whitney, and many equally noble elevations; on this ridge fourteen peaks are visible, ten as high as Mt. Brewer; four higher; and south, about eight miles, is the peak Kaweah. From Mt. Brewer the view near by is thus described by Mr. Gardner:

"Canons from two to five thousand feet deep, between their ridges, topped with pinnacles sharp as needles; successions of great, crater-like amphitheaters, with crowning precipices over sweeping snow-fields and frozen lakes; everywhere naked and shattered granite, without a sign of vegetation, except where a few gnarled and storm-beaten pines cling to the rocks in the deeper canons.

"The result of the summer's reconnoissance has been that a general idea is secured of the topography of a region about as large as Massachusetts, lying wholly within the State of California, and of which nothing whatever was known previously to this. That mountain peaks should be found to exist in this part of the State, higher than any known to exist in the United States, is a discovery equally interesting and unexpected. The details of this exploration will furnish many facts of great geological and geographical interest."

Ten years has added much to our knowledge of noble groups of mountains in central Colorado, the Rocky Mountains proper. For a long period our maps indicated the position of but two lofty peaks, one of which bore the name of Col. S. H. Long, whose explorations were made in the year 1820, while the other, originally called James's Peak, after the surgeon and botanist of Long's party who first ascended the summit in 1820, is now called Pike's Peak, after the explorer who calculated its height in 1806.

Pike's Peak was ascended in 1862 by Dr. C. C. Parry, the well-known botanist, who carried with him a barometer, and, with the aid of Dr. Engelmann, of St. Louis, ascertained the height to be 14,216 feet. It is very remarkable that, if we make allowance for an error clearly pointed out in James' commutation-base, we should find that his measurement (14,300 feet, as corrected) does not differ more than a hundred feet from that of Dr. Parry. We may, therefore, rest with some composure on the figure of 14,000, plus 200 or 300 feet, as the altitude of Pike's Peak — which is 2,500 feet more than our most common gazetteer assigns to it. Another rival claimant for our respect, still unintroduced upon our maps, is

Gray's Peak, or peaks — two summits, one of which bears the name of the Camor-Botar ; the other, that of Dr.

Torrey, the botanist, of New York. It was a natural tribute on the part of the botanist, Parry, to associate their names with a region of so much interest, and with elevations where the vegetation of many climes is recorded within a range of a few hours' climbing. We have two sprightly accounts of the ascent of Gray's Peak, to the height of 14,251 feet — one of them by Mr. Bowles, of Springfield, and his party, in 1868; the other by Mr. R. W. Raymond, published in a recent number of the Overland Monthly. The view, in Bowles' estimate, from Gray's Peak, was the great sight in all his Colorado travel. "In impressiveness, in overcomingness, it takes rank with three or four great natural wonders of the world — with Niagara Falls from the Tower, and Yo Semite Valley from Inspiration Point." Owing to the fact that mining has been carried as high as 12,000 feet, a wagon road ascends two-thirds of the way to the summit, with a horse trail beyond; so that Gray's Peak, a few years hence, will be one of the things "to be done" by tourists tired of Mount Washington or weary of the Adirondacks. Lincoln is the name assigned to "the great parent mount of ye parent range" which stands at the north-west angle of South Park, and may be easily ascended from Montgomery — up and back in five hours. The tourists dispute as to which summit offers the finest view, Gray's Peak or Mt. Lincoln, to which it is nearly parallel in altitude. (Bowles, P. R. R., 38 Switz., 114.) "Peer among presidents and mother among mountains" is Lincoln. The higher Gray's Peak is as high, possibly a hundred or two feet higher; but Mt. Lincoln is broader, more majestic, more mountainous. Out from its wide-spreading folds stretch three or four lines of snow-covered mountains; within its recesses spring the waters of three great rivers — the Platte, the Arkansas and the Colorado — that fertilize the plains of half the continent, and bury themselves, at last, two in the Atlantic and the third in the Pacific Ocean. This is the initial point in our geography and a fountain-head of national wealth and strength.

Bayard Taylor's reference to this peak is given in a letter which described his passage from the Middle Peak to South Peak, over a pass on the edge of Mt. Lincoln. He says:

"Directly to the west of us rose a knot of tremendous snowy steeps, crowned by a white, unbroken cone. This is Mt. Lincoln, believed to be the highest point in Colorado. The estimates vary between fifteen and eighteen thousand feet; but the most trustworthy measurement, which also corresponds with its apparent elevation above the pass — is sixteen thousand six hundred feet. Later in the season, it can be ascended without much difficulty.

"It is fortunate that this prominent summit is so appropriately named. It is the central point from which at least four snowy ranges radiate, is one thousand feet higher than any peak which has yet been measured, and the view from its snowy apex can hardly be drawn with a shorter radius than one hundred and fifty miles. Although not standing alone, like the volcanic cones of Oregon, but in the midst of a sublime Alpine world, it yet asserts its supremacy, and its huge, wintry buttresses form a prominent feature in the landscapes of the South Park. Lopris, some seventy miles west of Mt. Lincoln, is thought to be even higher."

In the summer of 1869, Prof. J. D. Whitney, accompanied by two of his former associates in the California Geological Survey, made triangulation of the region between Gray's Peak and the south edge of South Park, a map of which has been drawn on a scale of two miles to the inch. It covers an area of 3,500 square miles, including the whole of South Park.

One of the most interesting questions which can be raised in respect to the surface of a region is the height of its culminating peak; and although as a geogrophical fact this may be far less significant than the mean height of the mountain range, and as this again is subordinate in a commercial aspect to the height of the lowest passes across a mountain range, yet still popular interest on the one hand and scientific zeal on the other are often concentrated on the question which is the loftiest mountain. Let us then consider what new light the explorations of the last few years have thrown upon the highest summits of our own territory. For many years it was supposed that the loftiest peak in this country was among the Wind River.Mountains,—a range which is crossed by the 100th meridian, and lies not far from the latitude of northern New York.

Such was the belief of Capt. Bonneville, the gallant explorer, whose expedition across the continent, in the year 1832 and subsequently, was so pleasantly narrated by Mr. Washington Irving, and whose maps are regarded by the best authorities as "the first to represent correctly the hydrography of the region west of the Rocky Mountains." * It may interest you to be reminded of Bonneville's ascent of what he considered as not only the highest peak of the United States, but, as the highest peak of the North American, and which the Indians regarded as "the crest of the world." Although his own language cannot be quoted, we have that of his accomplished historian, which, doubtless, tells us how the explorer ought to feel in finding himself on such an eminence. Having attained the summit, "a scene burst upon the view of Capt. Bonneville, that for a time astonished and overwhelmed him with its immensity. He stood, in fact, upon that dividing ridge which Indians regard as the crest of the world ; and, on each side of which, the landscape may be said to decline to the two cardinal oceans of the globe. Whichever way he turned his eye, it was confounded by the vastness and variety of objects. Beneath him, the Rocky Mountains seemed to open all their secret recesses ; deep, solemn valleys, treasured lakes, dreary passes, rugged defiles

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* Warren's Memoir.

and foaming torrents; while beyond their savage precincts, the eye was lost in an almost immeasurable landscape, stretching on every side into dim and hazy distance, like the expanse of a summer's sea. Whichever way he looked, he beheld vast plains glimmering with reflected sunshine; mighty streams wandering on their shining course toward either ocean; and snowy mountains, chain beyond chain, and peak beyond peak, till they melted like clouds into the horizon. For a time, the Indian fable seemed realized; he had attained that height from which the Blackfoot warrior, after death, first catches a view of the land of souls, and beholds the happy hunting grounds spread out below him, brightening with the abodes of the free and generous spirits. The Captain stood for a long while gazing upon the scene, lost in a crowd of vague and indefinite ideas and sensations. A long-drawn inspiration at length relieved him from this enthrallment of the mind, and he began to analyze the parts of this vast panorama."

Bonneville having with him no instruments for the measurement of altitude, is of course an indefinite authority, and it is but just to add that Irving did not accord with him in supposing this to be the highest point of the continent; giving the pre-eminence to a more northern peak, then recently measured by Mr. Thompson, surveyor to the North-western Company.

The Rev. Samuel Parker, a missionary of the American Board, who went with Dr. Whitman and a party through the South Pass, in 1835, reported the highest peaks of the Rocky Mountains to be in that region, and said that "by measurement they were more than 18,000 feet high." (His narrative is not mentioned in Warren's Report. It was published in Ithaca, by the author, in 1838.) A decade had not passed from the time of Bonneville's ascent to the Wind River Mountains when Fremont, in the first of his famous expeditions, likewise attained their summit, with a kindred feeling of satisfaction that he had ascended the loftiest altitude of the United States; and there are not a few of us who can remember with what glowing words he describes the peak which still perpetuates his name, and with what echoes of enthusiasm, during an exciting political campaign, his success was heralded on half the platforms from Maine to California. Let me quote his own words: "We had accomplished," he says, "an object of laudable ambition, and beyond the strict order of our instructions. We had climbed the loftiest peak of the Rocky Mountain, and looked down upon the snow a thousand feet below; and, standing where never human foot had stood before, felt the exultation of first explorers." His barometerical measurement of the peak gave a height of 13,570 feet above the Gulf of Mexico, a figure which has not been changed on our most recent maps. His biographer tells us that "having planted the flag of the Union on the topmost peak of the central mountains, and inscribed the symbol (of the cross), dear to all believing hearts, upon the mighty monumental rock at their base, he had fulfilled the holiest aspirations of patriotism and piety, and, as the explorer of the vast interior of North America, had pledged and consecrated it to Republican Freedom and Christian Civilization." Early within the present decade the mountain pre-eminence was transferred from the eastern border of the great west upheaval to the western. A barometrical measurement of Mt. Shasta, by Mr. W. S. Moses, gave the height as 13,905 feet; Fremont had previously estimated it at 15,000 feet, and Lieut. Williamson, of the Pacific railroad, at 18,000. In 1862, the Geological Survey of California, under Prof. J. D. Whitney, made a careful series of observations, which determined the summit to be at an elevation of 14,440 feet. In December of that year, Prof. Whitney discussed, before the California Academy of Natural Science, the question of the highest mountain of the United States, comparing the accurate measurement of Mt. Shasta, made under his directions, with the data then at command respecting other peaks, and concluded that Shasta was "almost certainly" the highest point within the limits of the United States. Two years later Mt. Shasta, which had seemed to surpass the eastern summits, was compelled to bow its diminished head before a new aspirant for topographical pre-eminence, which was discovered in the south. Mr. Clarence King has the honor of being the discoverer, a young engineer but lately out of college, who had joined the survey of California as a volunteer assistant, and had accompanied the party surveying the "High Sierras." On the 6th of July, 1864, he ascended a peak which he had seen from Mt. Brewer, and found it over 14,000 feet. Here he saw two points of still greater altitude, and two of about equal altitude with that upon which he was standing, and to the mountain where he was he gave the name of Mt. Tyndall. But not yet satisfied, he made a brave effort to gain a still higher point. Once he was compelled to turn back; and again he made the attempt, but still the obstacles were too great for him, — but he had the satisfaction of gaining a point higher than any one had ever gained before within our territory. Let Prof. Whitney tell the story:

"The highest point reached by Mr. King in his efforts to scale the summit of Mt. Whitney was, according to the most reliable calculations, 14,740 feet above the sea-level. At the place where this observation was taken, he was, as near as he was able to estimate, between 300 and 400 feet lower than the culminating point of the mountain, which must therefore somewhat exceed 15,000 feet in height. So far as known, it is the highest point in the United States, and the elevation attained by Mr. King was greater than any other person has reached within our territories, or anywhere on the continent north of Popocatepetl.

"Mount Whitney is a ridge, having somewhat the outline of a helmet, the perpendicular face being turned toward the east. There is snow on its summit, which indicates that there must be a flat surface there. The mountain is the culminating point of an immense pile of granite, which is cut almost to the centre by numerous steep and often almost vertical canons, ending in high walled amphitheaters. Southward of the main peak there is a range of sharp needles, four of which are over 14,000 feet high. The general aspect of the group is much like that of Mt. Tyndall. This mountain has been approached on all sides, except from the east, and found to be utterly inaccessible. Mr. King thinks it possible, however, that some route may yet be found by which the summit can be reached."

After speaking of the Cordilleras, the lecturer next referred to Alaska, especially to the volume of the Coast Survey pertaining thereto, and the researches of Dall, Kennicott and others. The other topics of the address were: (1.) The contributions which have been made to the historical geography of this country, with special reference to the work of the Maine Historical Society; of the labored discussion of the same by Mr. Henry Stevens. (2.) Contributions to astronomy and mathematical geography, especially with reference to the new determinations of longitude. (3.) The hydrographic work of the Coast Survey, of the North Pacific exploring expedition, of the studies of various men of science upon the formation of our coast.

In conclusion, the lecturer dwelt briefly upon four points: (1.) The need of the National Topographical and Hydrographical Survey. (2.) The importance of scientific training for those who are going in any capacity to the new regions of the west. (3.) The legitimate work of "stay-at-home geographers," mountain clubs, etc., in the east; and (4) the value of the American Geographical Society and Journal.